COMANCHE PEAK STEAM ELECTRIC STATION UNITS 1 AND 2

DOCKET NOS. 50-445 AND 50-446

TXU GENERATION COMPANY LP

FAX RECEIVED BY K. MORTENSEN (NRC STAFF)

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Attachment 1

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1.0 SUMMARY OF RESULTS

The relays as identified in Section 2.1 provided by TXU – CPSES were cycled under the loads identified in Section 2.2 for a period of 1000 cycles each. The test results for each of the contacts on each relay showed little degradation of the contacts after 1000 cycles. This is evident from the contact resistance readings calculated from the voltage and current readings recorded at cycle number 1, 100, 200, 300, 500 and 1000. The loads are shown in Appendix B.

Anomaly #1 is written on Load 5 for Test #1 using the DC relay (ARD880UR) during the 300th cycle. Due to the bad plot from the oscilloscope, the plot was not readable and the reading was not taken. However, the readings from the other cycles showed no inconsistencies in the contact resistance for Load 5. The anomaly is contained in Appendix C.

Anomaly #2 is written for the different torque values used instead the stipulated torque value in the test plan. This was due to the different size of screws on the termination points. The anomaly is contained in Appendix C.

Based on the positive test results, the ARD and AR relays can properly operate the specific loads identified in Section 2.2 for a minimum of 1000 cycles. Although it was not a purpose of the test, the contact resistance readings supported a conclusion that the loads could be properly operated for a significantly more operations.

2.0 IDENTIFICATION OF TEST SPECIMENS & TEST LOADS

2.1 Test Specimens

The following test specimens are provided by TXU – CPSES. The testing was conducted at the NLI Fort Worth facility:

Item Description	Manufacturer / Part #	Serial #
Relay, 8 NO, 130Vdc coil, with screw terminals	Westinghouse / ARD-880UR With ARDCR cartridges	910.301-36
Relay, 8 NO, 120Vac coil, with screw terminals	Westinghouse / AR-880AR with ARCR cartridges	MA10529D/010/004

2.2 Test Loads

There are six test loads applied using the ARD relay and five test loads using the AR relay. The first five test loads are the same for both relays. The test loads are as follows:

LOAD#	Test Load Description	Manufacturer	Part #
1	Solenoid Valve	GE	128C298AA-1 TXU TSN: 150562
2	6.9kV Breaker Close/Trip coil	ITE Siemens Energy	RP 6.2.2.8-2/7 TXU TSN: 157070
3	480V SWGR Spring Release Device, 125Vdc	Westinghouse	3752A03G02 TXU TSN: 291745
4	480V SWGR Shunt Trip	Westinghouse	1A33593G04 TXU TSN: 381153
5	480V MCC Breaker Shunt Trip Coil	GE	TEDST12LS TXU TSN: 290567
6	AR880AR Relay Coil	Westinghouse	Coil on AR880AR Relay See Note 1

Note 1: This load is applicable only for Test #1 using the ARD880UR relay.

2.0 TEST SET-UP AND TEST RESULTS

The test set-up for each relay was performed in accordance with the electrical wiring diagram as described in the test plan. All interface hardware such as cables and terminal lugs were per the test plan. All terminations were torqued to values for the size of the termination screw and recorded in the test data sheets in Appendix A. See anomaly for torque values. Pictures of the test set-up are contained in Appendix B.

Calibrated multimeters were used to monitor the voltage across each contact and voltage across the resistor for each load. The resistance of the resistor was pre-determined based on the load current required for each load. The resistor values are shown in Appendix B for each load. The relays were energized at 125Vdc for the DC relay and 120Vac for the AC relay.

The contact resistance for each load using each of the relays were determined by computing the current through the resistor and using Ohm's law.

Contact resistance = Voltage across contact / Current through resistor

As for loads 2,3 & 4, the loads are DC coils which show voltage readings from the time it is energized and the plots shown in Appendix B are consistent with this type of loads. As for the rest of the loads, they are described as follows:

Load 1: The solenoid valve contains two coils; a starting coil and holding coil. The coils are wired in parallel to each other. In addition, there is capacitor and contact circuit in between these two coils. When voltage is first applied to the solenoid, the starting coil picks up and charges the capacitor. The starting coil drops out when the contacts opens and the holding coil is energized and remained energized. This may explain the voltage readings during the cycling test and the plot in Appendix B for Load 1.

Load 5: As the voltage is applied to the shunt trip in the circuit breaker, the current is cut-off due to the presence of a build-in contact in series with the shunt trip. This is consistent with the voltage readings recorded during the cycling test. See the plot in Appendix B for Load 5.

Load 6: This load is only applicable to the DC relay. The AC relay 120Vac coil was energized through the contact on the DC relay. The plot shows AC sinusoidal voltage waveforms for both the voltage across the contact and the voltage across the resistor. The contact resistance was computed using the Vrms/Irms values. The rms values were calculated by determining the peak values of the sinusoidal waveforms and multiplying the values by 0.7071.

The values that are out of scale or with polarity conflicts are not considered in the computation of the contact resistance values.

Below is the summary table of the average contact resistance values for each relay contact using the loads as specified in Section 2.2.

DC Relay ARD880UR

	Contact Resistance (Ω)					
No. of Cycles	Load 1	Load 2	Load 3	Load 4	Load 5	Load 6
1	0.127	0.237	0.534	0.541	1.330	0.064
100	0.131	0.271	0.532	0.555	0.984	0.067
200	0.136	0.250	0.550	0.552	1.050	0.024
300	0.133	0.253	0.543	0.589	Bad plot	0.029
500	0.134	0.278	0.596	0.553	1.070	0.031
1000	0.129	0.243	0.568	0.553	1.080	0.035

AC Relay AR880AR

	Contact Resistance (Ω)				
No. of Cycles	Load 1	Load 2	Load 3	Load 4	Load 5
1	0.140	0.260	0.535	0.538	1.080
100	0.133	0.221	0.555	0.610	1.030
200	0.127	0.250	0.588	0.577	1.040
300	0.137	0.250	0.620	0.631	1.040
500	0.130	0.295	0.598	0.552	1.050
1000	0.124	0.266	0.585	0.603	1.060

In addition, temperature readings were taken to ensure that the contacts do not overheat during each cycle. The relays were energized for at least 1 second and de-energized for a period of 90 seconds. The delay period of 90 seconds before energizing the relay for the next cycle is sufficient since the temperature readings showed no significant change. A copy of the temperature readings are contained in Appendix C.

4.0 ANOMALIES

Two anomalies were recorded for this test program. Details of each anomaly are contained in Appendix D.

5.0 QUALITY ASSURANCE

All activities have been performed in accordance with the NLI Quality Assurance program, which is in compliance with 10CFR50 Appendix B, 10CFR21 and ASME NQA-1 [7.3].

6.0 MEASUREMENT & TEST EQUIPMENT

All measurement and test equipment used to record the test data are documented in the test data contained in Appendix A.

7.0 REFERENCES

7.1 TXU Electric Purchase Order S 0334543 6D1 and attached test requirements.

7.2 NLI Test Plan TP-032009-1, Rev.5.

7.3 NLI Quality Assurance Manual, Rev. 1 dated 7/23/91.